NON-LINEAR DYNAMIC PREDICTIVE DEVICE

ABSTRACT OF THE DISCLOSURE

A non-linear dynamic predictive device (**60**) is disclosed which operates either in a *configuration* mode or in one of three runtime modes: *prediction* mode, *horizon* mode, or *reverse horizon* mode. An external device controller (**50**) sets the mode and determines the data source and the frequency of data. In the forward modes (prediction and horizon), the data are passed to a series of preprocessing units (**20**) which convert each input variable (**18**) from engineering units to normalized units. Each preprocessing unit feeds a delay unit (**22**) that time-aligns the input to take into account dead time effects. The output of each delay unit is passed to a dynamic filter unit (**24**). Each dynamic filter unit internally utilizes one or more feedback paths that provide representations of the dynamic information in the process. The outputs (**28**) of the dynamic filter units are passed to a non-linear approximator (**26**) which outputs a value in normalized units. The output of the approximator is passed to a post-processing unit (**32**) that converts the output to engineering units. This output represents a prediction of the output of the modeled process. In *reverse horizon* mode, data is passed through the device in a reverse flow to produce a set of outputs (**64**) at the input of the predictive device. These are returned to the device controller through path (**66**). The purpose of the *reverse horizon* mode is to provide information for process control and optimization. The predictive device approximates a large class of non-linear dynamic processes. The structure of the predictive device allows it to be incorporated into a practical multivariable non-linear Model Predictive Control scheme, or used to estimate process properties.